National Aeronautics and Space Administration

Ames

Discovery Innovations Solutions

NASA Ames' Robotic Exploration of the Moon and Beyond

March 28, 2017

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NASA Ames Research Center
Moffett Field, California

NASA Ames Research Center – Silicon Valley

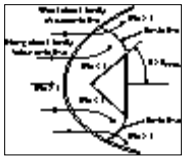
- **Founded 1939, 2nd oldest NASA center**
- **2500 employees**
  w/ another **1200** students in summers
- **$900M+ yearly budget**

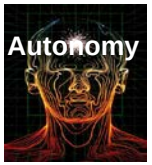
- **Science**
  - Space, Earth, Biological Sciences
  - Astrobiology, Lunar Science
- **Cost-Effective Space Missions**
  - Lunar Exploration
  - Small Spacecraft and Nanosatellites
- **Exploration Systems**
  - Autonomy, and Supercomputing
  - Entry Systems
- **Aeronautics & Aviation**
  - NextGen Air Traffic Management
  - Aviation Safety
- **Innovative & Entrepreneurial Collaborations**
  - NASA Research Park & 90 partners

78 Years of Innovation at Ames

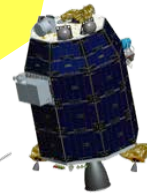
1939 - 2017


Flight Simulator

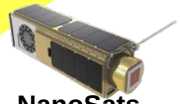

Blunt Body Concept



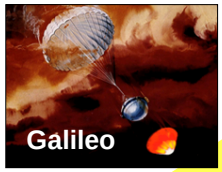
2017


LADEE

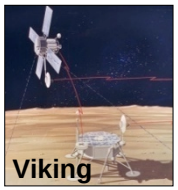
2010

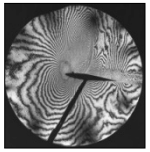

NanoSats

2000



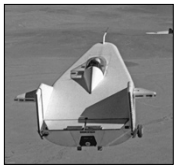
1990



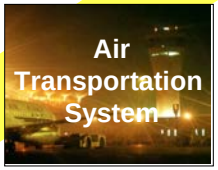

Transonic Flow

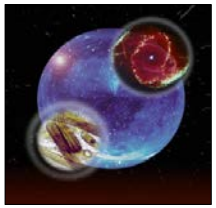

Pioneer Venus


Life Sciences Research

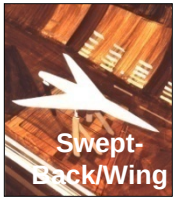

Lifting Body

1980



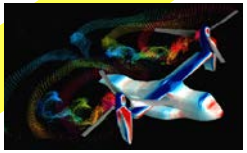

Astrobiology

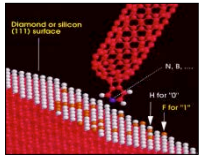
1970

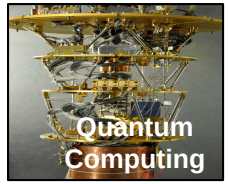



Flight Research

1960

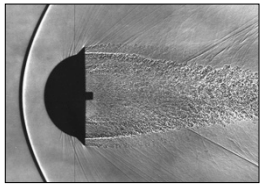

CFD


Nanotechnology

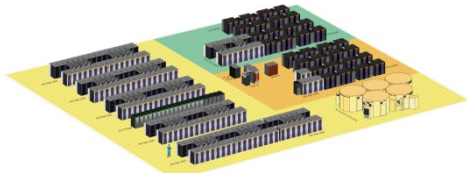


1950


Arcjet Research


Hypervelocity Free Flight


80x120 Wind Tunnel


One of the World's Fastest Operational Supercomputers

1940

Kepler / K2 Mission

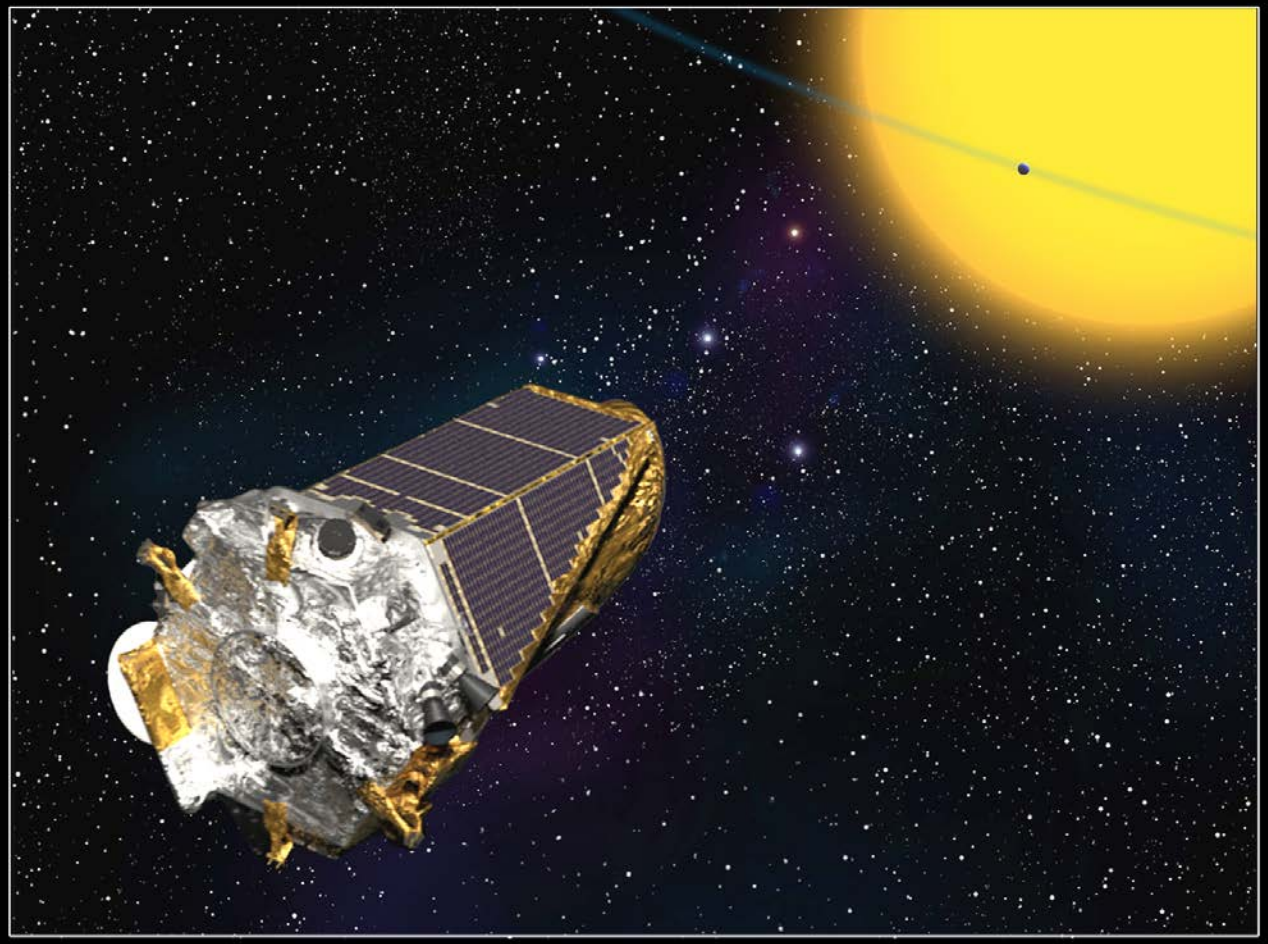
- **Find the number of Earth-size and larger planets in the habitable zone of sun-like stars**

Launched:
March 7, 2009

Observed
145,000 Stars

3461+
Confirmed
Planets

4496+
Candidate
Planets
to be confirmed



LCROSS Mission

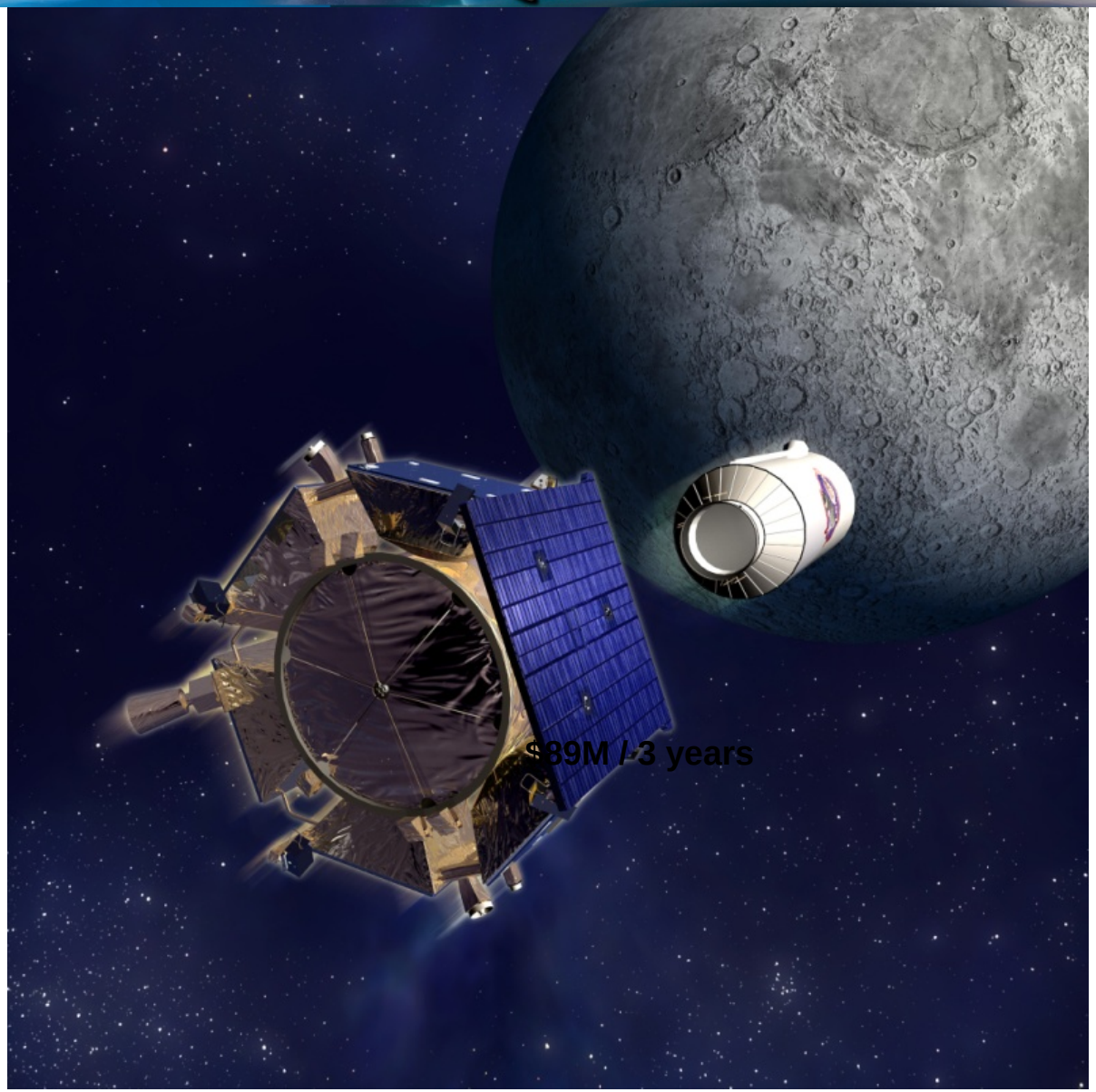
Lunar **CR**ater **O**bservation and **S**ensing **S**pacecraft

Launched: June 18, 2009
Impacted: October 9, 2009

Confirmed Water ice in permanently shadowed craters on the Moon

Demonstrated "Secondary" launch with another spacecraft

Impacted a "used" empty rocket and measured the result



LADEE : Lunar Atmosphere and Dust Environment Explorer

Measure the Lunar Dust and the Examine the Lunar atmosphere

- **Launched Sept 6, 2013**
- **Ended on April 18th, 2014**

- **First Composite Small Spacecraft**
- **Demonstrated Laser Communications from Lunar Orbit**

BioSentinel: Deep-Space Radiation BioSensor

Mission Objectives:

A CubeSat to be launched on NASA's first SLS

- 70 million miles from Earth at 18 months
- Far outside the protective shield of Earth's magnetosphere

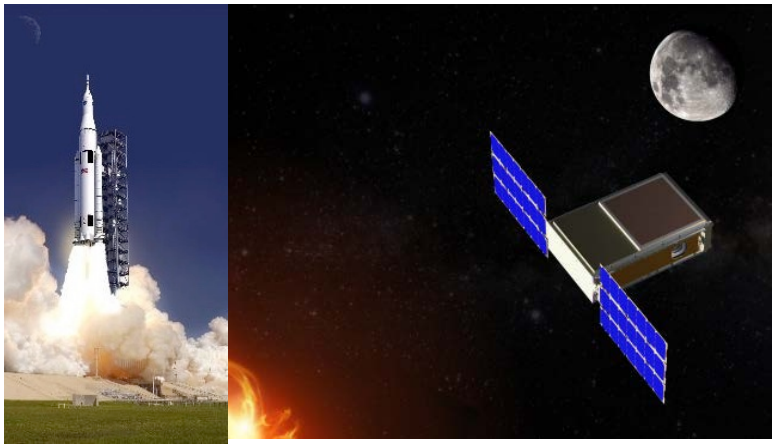
Conduct life science studies relevant to human exploration

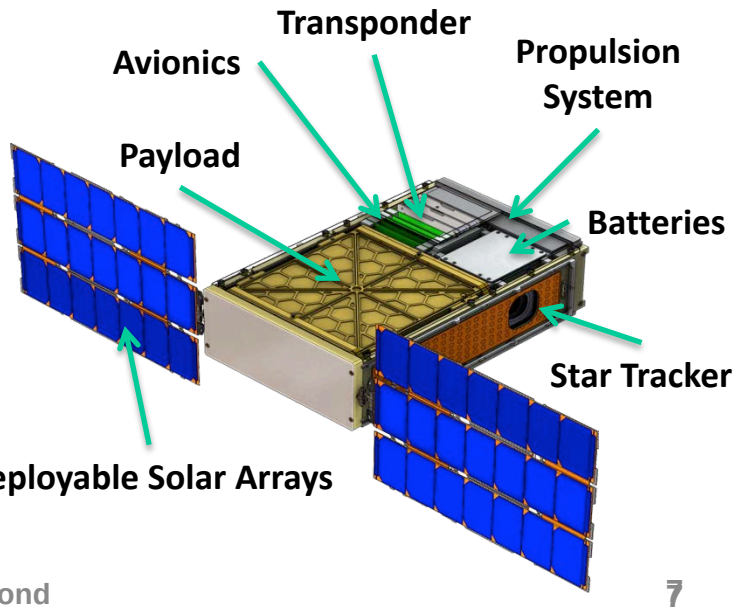
- 1st biological study beyond LEO in over 40 years
- Uses Yeast DNA as a BioSensor

Design payload with sensors for multiple environments

- Instrument on ISS at similar time to SLS launch
- Ground controls in lab and at radiation beam facilities

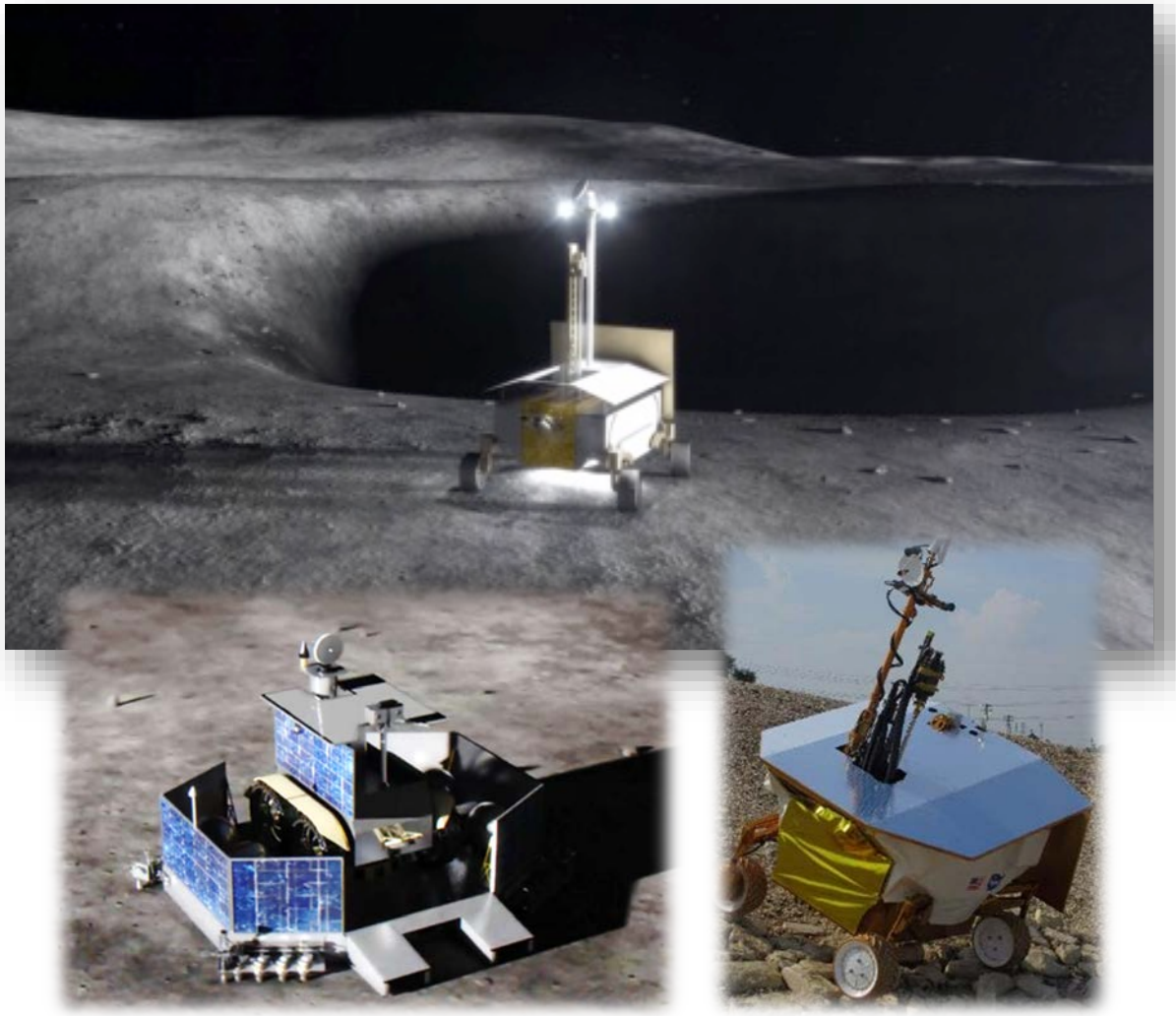
Expected Launch in 2019





Resource Prospector (RP) Mission

Understand the nature and distribution of water/ices in lunar polar soil



Mission:

- **Operate for 6-14 earth days**
- **Drive into permanently shadowed craters**
- **Prospect and Drill for Ices**
- **Determine composition of the Ices and their usabilty**
- **Expected Launch in FY21**

Summary

- Ames Research Center leads NASA in Lunar Exploration missions
- NASA Ames is actively developing and operating robotic missions for Lunar and Deep Space Exploration
- NASA Ames actively partners with California's Universities, Companies, and other Government labs to succeed

Questions?